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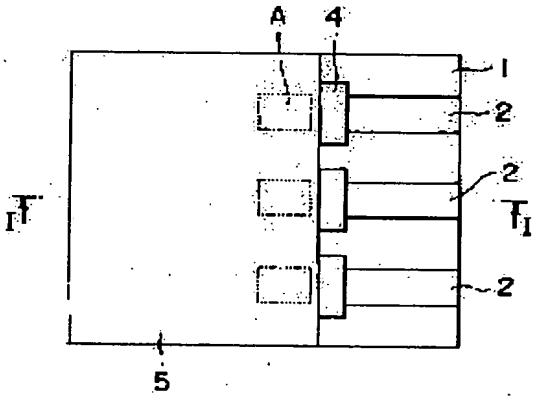
(54) ORGANIC ELECTROLUMINESCENT DISPLAY DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an organic electroluminescent display device, superior in the producibility and allowing simple patterning operation for the organic light-emitting layer.
SOLUTION: The organic electroluminescent display device is structured, so that organic electroluminescence elements each composed of a positive electrode layer, light-emitting layer containing organic light-emitting material, and a negative electrode layer are arranged on a base board, wherein the light- emitting layer is formed by gravure printing method.



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CLAIMS

[Claim(s)]
[Claim 1] The organic electroluminescence luminescence indicating equipment characterized by being the organic electroluminescence luminescence indicating equipment with which the organic electroluminescent element which consists of a positive electrode layer, a luminous layer containing an organic luminescent material, and a cathode layer is arranged, and forming this luminous layer by gravure on a substrate.
[Claim 2] The organic electroluminescence luminescence display according to claim 1 characterized by being in the range whose thickness of said luminous layer is 10-200nm.
[Claim 3] Claim 1 characterized by for an electron hole transportation layer existing and forming this electron hole transportation layer by the applying method between said luminous layer and a positive electrode layer, or an organic electroluminescence luminescence display given in 2.
[Claim 4] The organic electroluminescence luminescence display according to claim 3 characterized by forming the electron hole transportation layer by screen printing or gravure.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the luminescence display which consists of an organic electroluminescent element.
[0002]
[Description of the Prior Art] The luminescence indicating equipment using an organic electroluminescent element (henceforth an organic EL device) is advantageous at the point whose thin-shape-izing, lightweight-izing, and low-power-ization is attained compared with CRT which is a Braun-tube mold image display device. Moreover, an organic electroluminescence luminescence display has an advantage, like even if it compares with the liquid crystal display used as displays, such as a portable personal computer, the angle of visibility with a quick speed of response which does not need a back light since it is self-luminous is large. The luminescence display using the organic EL device which has such an advantage is expected as a next-generation display, and research of an organic EL device is done briskly.
[0003] An organic EL device consists of a positive electrode layer, a luminous layer (henceforth an organic luminous layer) containing an organic luminescent material, and a cathode layer. As for an organic EL device, it is common on a substrate to carry out the laminating of a positive electrode layer, an organic luminous layer, and the cathode layer in this order. And it is the component which emits light by emission (fluorescence, phosphorescence) of the light at the time of pouring a cathode layer to an electron into an organic luminous layer for an electron hole from a positive electrode layer, making an exciton (exciton) generate by making an electron and an electron hole recombine within an organic luminous layer, and this exciton deactivating. Moreover, an organic EL device can be made to emit light by the desired color by selecting an organic luminescent material contained in an organic luminous layer. The luminescence display using an organic EL device becomes by arranging one or more than it on a substrate about this organic EL device. Moreover, a color picture display etc. can be performed by arranging many organic EL devices for the organic EL device which emits light with the desired luminescent color in the shape of a pattern as one pixel.
[0004] Luminescence of an organic EL device is produced in the organic luminous layer inserted into the positive electrode layer and the cathode layer. That is, an organic luminous layer emits light in an organic EL device in the form of a part where three layers, a positive electrode layer, an organic luminous layer, and a cathode layer, have lapped, in view of a cathode layer side. The form of a part where this organic luminous layer emits light is hereafter indicated to be a luminescence pattern. Therefore, what is necessary is just to carry out patterning of at least one layer in each class which constitutes an organic EL device to a desired configuration, in order to decide the luminescence pattern of an organic EL device.
[0005] An organic luminescent material contained in the organic luminous layer of an organic EL device is weak for an organic solvent or moisture. Therefore, also when patterning of the organic luminous layer is carried out according to the photolithography process usually performed by micro processing, such as a semi-conductor, and the luminescence property of an organic EL device does not change or it stops emitting light, it is. Therefore, in case the organic EL device which emits light in one color was formed, as for patterning of a luminous layer, it was common to have carried out patterning of a positive electrode layer or the cathode layer, to have formed an organic

electroluminescence light emitting device, without carrying out, and to have defined a luminescence pattern.

[0006] Moreover, in the display which emits light in two or more colors, since it is necessary to arrange two or more organic electroluminescence light emitting devices which emit light by different color on the same substrate, it is necessary to perform patterning of an organic luminous layer. For this reason, in the former, patterning of an organic luminous layer was performed by the approach of placing on a substrate the mask which has the hole of a desired configuration before forming a luminous layer, forming an organic luminous layer with a vacuum deposition method from on that, and removing a mask after that. Since it was necessary to carry out by preparing a mask for every (every different organic luminescent material) luminescent color, and repeating the process of patterning by the patterning method using this mask, it was the approach of time and effort requiring very much. Moreover, the approach of carrying out patterning of the organic luminous layer by ink jet printing is learned, using the solution which contains an organic luminescent material completely unlike the technique of such patterning as ink of ink jet print processes.

[0007]

[Problem(s) to be Solved by the Invention] As mentioned above, although there was the need of performing patterning of an organic luminous layer in order to have produced the organic electroluminescence luminescence display which emits light in two or more colors, by the patterning method using a mask, there were many routing counters and it had taken time and effort. Moreover, although patterning of the organic luminous layer by the ink jet method is an approach that a shadow mask is not required and simple, it needs to move the head which carries out the regurgitation of the ink, and cannot say it as a desirable approach in respect of productivity. Moreover, since it consists of the aggregate of the circular dot in the ink breathed out from the head, it is difficult for the configuration formed by the ink jet method to form the edge of the configuration of an organic luminous layer smoothly.

[0008] The purpose of this invention is to offer the organic electroluminescence luminescence display which is characterized by performing patterning of an organic luminous layer by the simple method of being able to form the edge of the configuration of an organic luminous layer smoothly, and not using a mask and which is excellent in productivity.

[0009]

[Means for Solving the Problem] This invention is shown in the organic electroluminescence luminescence indicating equipment characterized by being the organic electroluminescence luminescence indicating equipment with which the organic electroluminescent element which consists of a positive electrode layer, a luminous layer containing an organic luminescent material, and a cathode layer is arranged, and forming this luminous layer by gravure on a substrate.

[0010] Moreover, in the organic electroluminescence luminescence display of this invention, it is desirable that it is in the range whose thickness of said luminous layer is 10-200nm. Moreover, it is desirable that an electron hole transportation layer exists and this electron hole transportation layer is formed by the applying method between said luminous layer and a positive electrode layer, and it is still more desirable that this electron hole transportation layer is formed by screen printing or gravure.

[0011]

[Embodiment of the Invention] [Configuration of luminescence display] drawing 1 is the top view showing the configuration of an example of the organic electroluminescence luminescence display of this invention. Moreover, drawing 2 is the sectional view cut along the direction to which I-I entered in the front view having shown the organic electroluminescence display in drawing 1 is connected. It comes to carry out the laminating of the luminous layer (organic luminous layer) 4 in which the organic EL device used for the luminescence display of this invention contains the positive electrode layer 2 and an organic luminescent material on a substrate 1, and the cathode 5. And an organic EL device emits light by impressing an electrical potential difference to a positive electrode layer and a cathode layer. Moreover, the luminescence pattern at this time is the configuration of a part where the positive electrode layer, the organic luminous layer, and the cathode layer have lapped, and emits light in the configuration A shown with the wavy line in drawing 1 .

[0012] Drawing 3 is the top view showing the configuration of another example of the organic

electroluminescence luminescence display of this invention. Moreover, drawing 4 is the sectional view cut along the direction to which II-II entered in the front view having shown the organic electroluminescence display in drawing 3 is connected. The electron hole transportation layer 3 is formed in the organic EL device of the organic electroluminescence luminescence display shown in drawing 3 between the positive electrode layer 2 and the organic luminous layer 4. It comes to carry out the laminating of the luminous layer (organic luminous layer) 4 in which the organic EL device used for the luminescence display of this invention contains the positive electrode layer 2, the electron hole transportation layer 3, and an organic luminescent material on a substrate 1, and the cathode layer 5. And an organic EL device emits light by impressing an electrical potential difference to a positive electrode layer and a cathode layer. Moreover, the luminescence pattern at this time is the configuration of a part where the positive electrode layer, the electron hole transportation layer, the organic luminous layer, and the cathode layer have lapped, and emits light in the configuration B shown with the wavy line in drawing 3 .

[0013] As for a [organic electroluminescence light emitting device] organic electroluminescence light emitting device, it is common to be able to manufacture by forming a positive electrode layer (or cathode layer), an organic luminous layer, and a cathode layer (or positive electrode layer) in order, and carrying out a laminating, to form a positive electrode layer on a substrate first, and to form an organic luminous layer and a cathode layer subsequently on a substrate.

[0014] In order to obtain a desired image using an organic electroluminescence light emitting device, it is necessary to carry out patterning of a positive electrode layer, an organic luminous layer, and the cathode layer according to the image. As an approach of carrying out patterning of a positive electrode layer and the cathode layer, beforehand, a positive electrode layer or a cathode layer is formed, and the approach of etching, the approach of masking a substrate and forming a positive electrode layer and a cathode layer, etc. are mentioned to the large area on a substrate. Moreover, an organic EL device in three primary colors may be arranged to a luminescence display, a thin film transistor (TFT) component may be prepared in a substrate according to the applications in the case of obtaining a full color image etc., and patterning of a positive electrode layer and the cathode layer may be carried out on it. There is especially no limit about the ingredient of the substrate with which an organic electroluminescence light emitting device is prepared, and glass, plastics, a quartz, etc. can be used.

[0015] If it is the large (4eV or more) metal, the alloy, the electrical conductivity compounds, and such mixture of a work function as an ingredient of a [positive electrode layer] positive electrode layer, there is especially no limit and it can use a well-known ingredient. As an example of the ingredient of a concrete positive electrode layer, electrical conductivity transparent materials, such as metals, such as gold, or CuI, ITO (indiumtinoxide) and SnO2, and ZnO, etc. can be mentioned. In addition, when taking out luminescence of an organic EL device from a positive electrode layer side, as for the permeability of the light of a positive electrode layer, it is desirable that it is 10% or more, and, as for the substrate which forms a positive electrode layer, it is desirable that the permeability of the light is 70% or more of glass plate. Moreover, as for resistance of a positive electrode layer, it is desirable that it is below hundreds ohm/sq . Furthermore, although the thickness of a positive electrode layer is based also on an ingredient, it is usually within the limits of 50-200nm preferably 10nm - 1 micrometer. There is especially no limit in the formation approach of a positive electrode layer, and a well-known approach can be used. As an example of the formation approach of a positive electrode layer, a vacuum deposition method, a direct-current (DC) spatter, a RF (RF) spatter, etc. are mentioned.

[0016] There is especially no limit in the ingredient of a [organic luminous layer] organic luminous layer (luminous layer containing an organic luminescent material), and the well-known ingredient used at the organic luminous layer of an organic EL device can be used. As an organic luminous layer, an organic luminescent material and the organic material with which the fluorochrome (luminescence agent) was doped can be used. Moreover, in order to acquire practical luminous efficiency, as for the thickness of an organic luminous layer, it is desirable that it is the range of 10-200nm. Moreover, in this invention, in order to form an organic luminous layer with gravure, as for the organic material used for an organic luminous layer, it is desirable that it is meltable to a solvent.

[0017] "As the example of an organic luminescent material A photoelectron functional organic

material handbook (the 2nd **), Asakura Publishing issue Electronic transportability luminescent material indicated by 396-398 pages (Table III. 2.32)," said -- the hole transportability luminescent material (Table III. 2.33) indicated by 398-399 pages -- said -- the luminescent material in the three-layer constituent child indicated by 399-400 pages -- and -- said -- the luminescent material (Table III. 2.36) of the monolayer mold component indicated by 403-404 pages etc. can be mentioned. Moreover, in order to adjust the luminescent color, a fluorochrome can also be doped to an organic material.

[0018] Moreover, the electron hole (hole) transportation ingredient (drawing III. 2.28) indicated by "photoelectron functional organic material handbook" 395 page as an example of the organic material with which a fluorochrome is doped, the electronic transportation ingredient (drawing III. 2.29) indicated by the pages 402 of said are mentioned. As an example of an electron hole transportation ingredient, a tetra-aryl BENJISHIN compound, aromatic amine, a pyrazoline derivative, a triphenylene derivative, etc. are mentioned. Tetra-phenyl diamine (TPD) is mentioned as a desirable example. Moreover, an electron hole transportation ingredient is a polymer which has an electron hole transportation unit containing two or more (preferably three or more pieces) aromatic series rings, and it is desirable that it is what contains a disconjugation radical in a principal chain. A polyvinyl carbazole (PVCz) etc. can be mentioned as an example of the compound which contains a disconjugation radical in a two-piece hidden principal chain for an aromatic series ring.

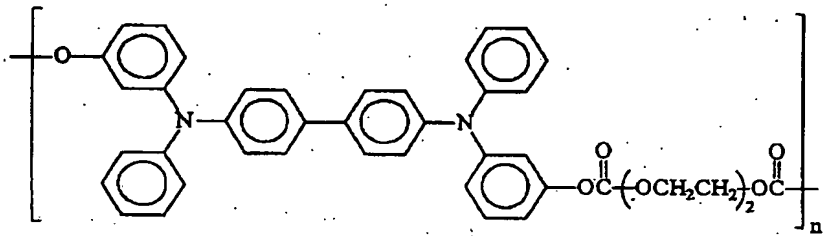
[0019] As an example of the compound which contains a disconjugation radical in a three or more piece hidden principal chain, an aromatic series ring Diamine, thoria reel amine oligomer, thiophene oligomer, The organic compound (it is also called an electron hole transportation unit) containing three or more aromatic series rings which consist of units of the compound origin chosen from arylene vinylene oligomer and a styryl amine The polymer which it comes to connect by the connection radical which has disconjugation radicals, such as an ester group, a ether group, a carbonate radical, a urethane group, an amide group, a sulfone radical, and a ketone group, can be mentioned.

[0020] aromatic series -- a ring -- three -- a piece -- more than -- containing -- a principal chain -- disconjugation -- a radical -- containing -- a compound -- an example -- ****** -- the following -- a structure expression -- expressing -- having -- copoly -- [-- three -- three -- ' - hydroxytetraphenyl -- a benzidine -- /-- a diethylene glycol --] -- carbonate (henceforth PC-TPD-DEG) -- copoly -- [-- three -- three -- ' - hydroxytetraphenyl -- a benzidine -- /-- hexamethylene --] -- carbonate (henceforth PC-TPD-HM) -- it can mention .

[0021]

[Formula 1]

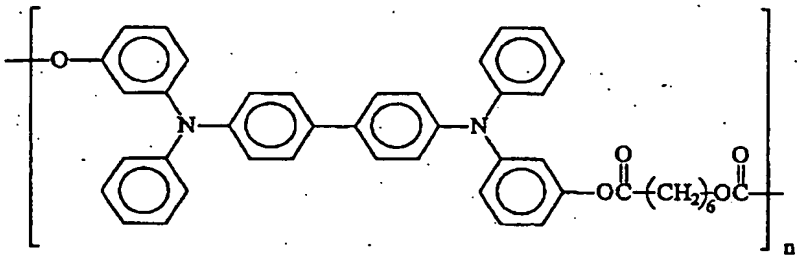
PC-TPD-DEG;



[0022]

[Formula 2]

PC-TPD-HM;



[0023] As an example of a fluorochrome, the doping coloring matter (Table III. 2.35) indicated by "photoelectron functional organic material handbook" 400-401 page is mentioned. Moreover, as an example of a fluorochrome, a coumarin, a DCM derivative, Quinacridone, perylene, rubrene, etc. are mentioned. The desired luminescent color can be obtained by choosing the ingredient of these fluorochromes.

[0024] What is necessary is to dissolve the organic material which forms the above-mentioned organic luminous layer in an organic solvent, and just to consider as the ink for printing, in order to form an organic luminous layer with gravure. If an organic luminescent material can be dissolved in the class of organic solvent, there will be especially no limit in it, but if the vapor rate of an organic solvent is early, problems, such as a rise of ink viscosity and ink fixing to a lithographic plate, will arise. Therefore, it is desirable that the vapor pressure in 25 degrees C of an organic solvent is within the limits of 0.1 - 20mmHg. As an example of such an organic solvent, a cyclohexanone, a chlorobenzene, o-dichlorobenzene, a tetralin, 1,2,4-trichlorobenzene, etc. can be mentioned. Moreover, in order to make thickness of an organic luminous layer into the aforementioned thickness, as for the concentration to the organic solvent of the ingredient which forms an organic luminous layer, it is desirable that it is in the range of 1 thru/or 15 mass %, and it is still more desirable that it is in the range of 2 thru/or 9 mass %.

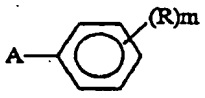
[0025] Here, the gravure for forming an organic luminous layer is explained briefly. Gravure is a kind of an intaglio-printing method. Generally, gravure is the approach of printing the lithographic plate engraved by photoengraving process as a lithographic plate of a printing machine. Moreover, the printing machine which has this lithographic plate by which photoengraving process was carried out is called the photogravure printing machine. In gravure, ink is put in the crevice of a large number called a cel prepared on the surface of the lithographic plate, and printing is performed by making a printing hand-ed transfer ink through and by pressurizing in a printing hand-ed between the rubber covered rolls called this lithographic plate and impression cylinder. A setup of the configuration (area and depth) of the cel of these large number adjusts a shade. Moreover, it is classified into a conventional gravure method, an inverted halftone gravure method, an electronic sculpture gravure method, etc. according to the method of a setup of the configuration of a cel.

[0026] A conventional gravure method sets up the shade of the printed pattern by change of the amount of the ink by depth change of a cel, although the area of a cel is the same. An inverted halftone gravure method fixes the depth of a cel, and is divided roughly into two, the method which sets up the shade of the printed pattern by change of the amount of the ink by area change of a cel, and the method to which both the depth and area of a cel are changed. Moreover, an electronic sculpture gravure method is a method which forms a cel using an electronic engraving machine. Moreover, the ink used with gravure is ink of comparison-hypoviscosity which consists of an organic solvent which mainly dissolves resin and resin, and a pigment (or color), and it is designed so that a photogravure printing machine may also fit it.

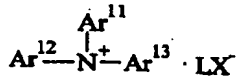
[0027] In this invention, the intaglio with which the pattern of a luminous layer was given is used as a lithographic plate of the photogravure printing machine which forms the pattern of an organic luminous layer. The method of engraving an intaglio is well-known, and can use a sculpture intaglio, the intaglio by which photoengraving process was carried out. Moreover, in order to make a luminous layer into the aforementioned thickness, it is desirable to set to 30 micrometers or less the depth of the pattern of the luminous layer prepared in an intaglio, and it is still more desirable to be

referred to as 15 micrometers or less.
[0028] If gravure is performed to the photogravure printing machine prepared as mentioned above using the above-mentioned ink, the pattern formation of a smooth organic luminous layer is possible also for the edge of a pattern. Moreover, in the common photogravure printing machine, in order to color-print, it has two or more lithographic plates in one set of a printing machine. Therefore, if it prints by preparing the ink containing an organic luminescent material which presents the desired luminescent color to each lithographic plate, and the intaglio which gave the pattern configuration for a photogravure printing machine in producing the organic electroluminescence luminescence display which emits light in two or more colors, it is one-time presswork, and since the organic luminous layer which consists of a mutually different ingredient can be formed, it is simple.
[0029] Moreover, gravure is a kind of an intaglio-printing method and is used for printing also with a common intaglio-printing machine apart from the photogravure printing machine. Intaglio printing can also print an organic luminous layer similarly. However, the usual intaglio-printing machine is characterized by the ability to perform printing which has a feeling of padding using oxidation-polymerization mold ink, and it is designed so that it may be suitable for oxidation-polymerization mold ink with viscosity higher than the ink for gravures. Moreover, since an intaglio-printing machine has the slow rate of drying of oxidation-polymerization mold ink, generally a lithographic plate is installed one and it performs monochrome printing in many cases. Therefore, it is desirable to use a photogravure printing machine in this invention which uses as the ink for printing the solution of hypoviscosity which diluted the ingredient of an organic luminous layer with the organic solvent.
[0030] If it is the small (4eV or less) metal, the alloy, the electrical conductivity compounds, and such mixture of a work function as an ingredient of a [cathode layer] cathode layer, there is especially no limit and it can use a well-known ingredient. As an example of the ingredient of a concrete cathode layer, Na, K, Mg, Li, In, a rare earth metal, a Na-K alloy, a Mg-Ag alloy, a Mg-Cu alloy, an aluminum-Li alloy, and 2Oaluminum/aluminum3 mixture can be mentioned. When taking out luminescence from a cathode layer, as for the permeability of the light of a cathode layer, it is desirable that it is 10% or more. Moreover, as for resistance of a cathode layer, it is desirable that it is below hundreds ohm/sq . Furthermore, although the thickness of a cathode layer is based also on an ingredient, it is usually within the limits of 50-200nm preferably 10nm - 1 micrometer. There is especially no limit in the formation approach of a cathode layer, and a well-known approach can be used. As an example of the formation approach of a cathode layer, a vacuum deposition method, a direct-current (DC) spatter, a RF (RF) spatter, etc. are used.
[0031] [Electron hole transportation layer] By this invention, an electron hole transportation layer can also be prepared between an organic luminous layer and a positive electrode layer again. The electron hole transportation layer has the function make an electron hole easy to inject into a luminescent-material layer. About the organic EL device with which the electron hole transportation layer was prepared, for example, it is indicated by the "macromolecule" 47-volume July issue (1998) 457-460 etc., and is well-known. The laminating of the electron hole transportation layer may be carried out more than a bilayer also by the monolayer. the formation approach of an electron hole transportation layer -- especially -- a limit -- there is nothing -- vacuum evaporation technique, a spin coat method, the cast method, and LB -- law, the ink jet method, etc. are used. Moreover, since the electron hole transportation layer of two or more organic EL devices can be formed in a desired pattern configuration simple, it is desirable to form an electron hole transportation layer with gravure like an organic luminous layer or to form with screen printing.
[0032] There is especially no limit in the electron hole transportation ingredient used for an electron hole transportation layer, and the electron hole transportation ingredient indicated by explanation of the aforementioned organic luminous layer can be used. Moreover, in order to raise electron hole transportability in an electron hole transportation layer, an electronic receptiveness acceptor can be doped. If an electronic receptiveness acceptor oxidizes the above-mentioned electron hole transportation ingredient, there will be especially no limit. For example, the thing which was chosen from salts with a halogenation metal, Lewis acid, an organic acid and arylamine, a halogenation metal, or Lewis acid and which is a kind at least is desirable, and may use these combining two or more sorts.

[0033] As a desirable example of a halogenation metal or Lewis acid, FeCl3, AlCl3, SbCl5, AsF5, BF3, etc. can be mentioned.
[0034] As an example of an organic acid, the compound expressed with the following general formula (I) can be mentioned.
[0035]
[Formula 3]
一般式（I）；

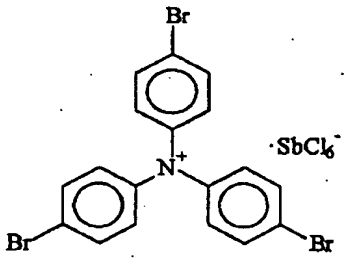


[0036] In the above-mentioned general formula (I), A is acid radicals, such as a sulfonic group, a phosphoric-acid radical, a boric-acid radical, and a carboxylic-acid radical. R is heterocycle type machines, such as a pyridyl radical, a quinolyl radical, a furanyl radical, a pyrrolyl radical, and a thienyl group, or a halogen atom, a nitro group, a cyano group, an epoxy group, etc. at the alkyl group of carbon numbers 1-20, an alkoxy group, an alkylthio group, the alkoxyalkyl group of carbon numbers 2-20, an alkylthio alkyl group, an alkenyl radical, the cycloalkyl radical of carbon numbers 5-20, the aryl group of carbon numbers 6-20, the ARUKA reel radical of carbon numbers 7-20, an aralkyl radical, and a pan m is the positive number of 0-5. When m is two or more, even if R is mutually the same, it may differ.
[0037] Furthermore, as another example of an organic acid, polymer acids, such as polymer acids, such as sulfonated polystyrene, sulfonation polyethylene, and sulfonation poly car baud NETO, and an acrylic-acid polymer, can be mentioned.
[0038] As an example of a salt with arylamine, a halogenation metal, or Lewis acid, the salt expressed with the following general formula (II) can be mentioned.
[0039]
[Formula 4]
一般式（II）；



[0040] In the above-mentioned general formula (II), L is a halogenation metal or Lewis acid, for example, can mention FeCl3, AlCl3, SbCl5, AsF5, BF3, etc. X- is halogen ion preferably. Ar11-Ar13 are the aromatic series radicals or heterocycle type machines of carbon numbers 5-30 which are not permuted [a permutation or] independently, respectively. As a desirable substituent, the carbon number of the monochrome of 1-24 or a dialkylamino radical, and an aryl group can mention [the carbon number of a halogen atom, a nitro group, a cyano group, a carbon number 1 - 24 alkyl groups the aryl group of carbon numbers 6-24, the aralkyl radical of carbon numbers 7-24, a carbon number 1 - 24 alkoxy groups, the aryloxy group of carbon numbers 6-24, and an alkyl group] monochrome or a diaryl amino group of 6-24 etc.
[0041] As a desirable thing, the tris (4-BUROMO phenyl) ammonium hexa chloro antimonate (henceforth TBAHA) expressed with the following structure expression can be mentioned in the salt expressed with the above-mentioned general formula.
[0042]
[Formula 5]

TBAHA ;



[0043] When forming an electron hole transportation layer only using the above-mentioned electron hole transportation ingredient, as for the thickness, it is desirable that it is the range of 2-200nm. Moreover, what is necessary is for the range of the thickness of an electron hole transportation layer just to be 2-5000nm, since electron hole transportability improves when forming an electron hole transportation layer using the electron hole transportation ingredient with which the electronic receptiveness acceptor was doped.
[0044] When forming an electron hole transportation layer by gravure or screen-stencil, it can consider as the ink for printing by adding an electronic receptiveness acceptor, if it is required for the above-mentioned electron hole transportation ingredient and is, and dissolving in an organic solvent. Although there will be especially no limit in it if an electron hole transportation ingredient can be dissolved in the class of organic solvent, it is desirable that the vapor pressure in 25 degrees C is within the limits of 0.1 - 20mmHg. As an example of such an organic solvent, a cyclohexanone, a chlorobenzene, o-dichlorobenzene, a tetralin, 1,2,4-trichlorobenzene, etc. can be mentioned.
[0045] Moreover, in order to make thickness of an electron hole transportation layer into the aforementioned thickness, when using only an electron hole transportation ingredient and forming an electron hole transportation layer, as for the concentration to the organic solvent of the ingredient which forms an organic luminous layer, it is desirable that it is in the range of 1 thru/or 15 mass %, and it is still more desirable that it is in the range of 2 thru/or 9 mass %. Moreover, when forming an electron hole transportation layer using the electron hole transportation ingredient with which the electronic receptiveness acceptor was doped, as for the concentration to the organic solvent of the ingredient which forms an organic luminous layer, it is desirable that it is in the range of 1 thru/or 15 mass %, and it is still more desirable that it is in the range of 2 thru/or 9 mass %.
[0046] When forming an electron hole transportation layer with gravure, the above-mentioned ink adjusted using the electron hole transportation ingredient can be formed by carrying out gravure like an organic luminous layer. Moreover, the electron hole transportation layer which consists of an electron hole transportation ingredient with which the electronic receptiveness acceptor was doped can be formed also with screen printing. When forming an electron hole transportation layer with screen printing, the screen version with which the desired pattern is formed on the positive electrode layer formed on the substrate is arranged. Subsequently, the above-mentioned ink is put on the screen version, ink is pressurized with the rubber of the shape of a spatula with the thickness called a squeegee, and it applies to a desired pattern. And the applied ink is dried. By changing the strength which pressurizes ink, if the thickness of an electron hole transportation layer is within the limits of 0.5-5 micrometers, it can be set as arbitration. Moreover, it is desirable that it is within the limits of 1-5 micrometers, as for the thickness of an electron hole transportation layer, it is more desirable that it is in within the limits which is 1-3 micrometers, and it is still more desirable that it is in within the limits which is 1-2 micrometers.
[0047] There is no special limit in the ingredient of the screen version used for the above-mentioned screen printing, and it can use well-known things, such as a polyamide, a fluororesin, and stainless steel, for it. Moreover, there is especially no limit also in the desiccation approach of ink, for example, it may be put in and dried to it at an oven. Moreover, if the drying temperature of ink is temperature higher than the boiling point of an organic solvent, it does not have a limit especially.
[0048]
[Effect of the Invention] In the organic electroluminescence luminescence indicating equipment of

this invention, the organic luminous layer of an organic EL device is formed by gravure. Using the intaglio with which the pattern configuration of an organic luminous layer was given as a lithographic plate of a photogravure printing machine, the edge of the pattern configuration of an organic luminous layer can form smoothly by forming an organic luminous layer by printing, and the luminescence display which could save time and effort from the case where patterning of an organic luminous layer is performed using an old mask, and was excellent in productivity is offered.

[0049]

[Example] On a polyester film substrate with a [example 1] thickness of 125 micrometers, resistance is an ITO thin film 50ohms/cm 2 It formed with the vacuum deposition method so that it might become. The produced ITO thin film was etched according to the photolithography process, and the positive electrode layer of the configuration shown in drawing 1 was formed. The thickness of the formed positive electrode layer was 0.15 micrometers. In order to form an organic luminous layer with gravure, PC-TPD-DEG0.95g and rubrene 0.05g were dissolved in 14.00g of organic solvents of the 1:1-fold quantitative ratio of o-dichlorobenzene and 1,2,4-trichlorobenzene, and the ink for printing was produced. Next, the above-mentioned ink was supplied to the photogravure printing machine furnished with the intaglio with which the pattern (crevice) of a luminous layer with a depth of 10 micrometers was prepared, and ink was printed in the configuration shown at drawing 1 on the ITO thin film. And the ink applied into the vacuum was heated at 80 degrees C for 1 hour, the solvent was removed, and the organic luminous layer was formed. The thickness of the formed organic luminous layer was 0.100 micrometers.

[0050] Next, it was carried on the produced organic luminous layer, having used the sheet metal made from stainless steel as the mask so that the part which forms a cathode layer might be exposed. And the cathode layer of the configuration shown in drawing 1 was formed by carrying out vacuum deposition of the Mg-Ag alloy to the thickness of 200nm, and removing a mask from on the. The luminescence display which was formed from the positive electrode layer, the organic luminous layer, and the cathode layer as mentioned above and which consists of three organic EL devices was manufactured. The electrical potential difference of 20V is impressed between an ITO electrode and a Mg-Ag alloy electrode to one of the organic EL devices of the luminescence display produced as mentioned above, and it is 1000 cd/m2. Luminescence of brightness was observed.

[0051] On a polyester film substrate with a [example 2] thickness of 125 micrometers, resistance is an ITO thin film 50ohms/cm 2 It formed with the vacuum deposition method so that it might become. The produced ITO thin film was etched according to the photolithography process, and the positive electrode layer of the configuration shown in drawing 2 was formed. The thickness of the formed positive electrode layer was 0.15 micrometers. In order to form an electron hole transportation layer with gravure, PC-TPD-DEG0.95g and TBAHA0.15g were dissolved in 15.00g of organic solvents of the 1:1-fold quantitative ratio of o-dichlorobenzene and 1,2,4-trichlorobenzene, and the ink for printing was produced. Next, the above-mentioned ink was supplied to the photogravure printing machine furnished with the intaglio with which the pattern (crevice) of the electron hole transportation layer whose depth is 10 micrometers was prepared, and ink was printed in the configuration shown at drawing 3 on the ITO thin film. And the ink applied into the vacuum was heated at 80 degrees C for 1 hour, the solvent was removed, and the electron hole transportation layer was formed. The thickness of the formed electron hole transportation layer was 0.105 micrometers.

[0052] Next, in order to form an organic luminous layer with gravure, PC-TPD-DEG0.95g and rubrene 0.05g were dissolved in 14.00g of organic solvents of the 1:1-fold quantitative ratio of o-dichlorobenzene and 1,2,4-trichlorobenzene, and the ink for printing was produced. Next, the above-mentioned ink was supplied to the photogravure printing machine furnished with the intaglio with which the pattern (crevice) of a luminous layer with a depth of 10 micrometers was prepared, and ink was printed in the configuration shown at drawing 3 on the electron hole transportation layer. And the ink applied into the vacuum was heated at 80 degrees C for 1 hour, the solvent was removed, and the organic luminous layer was formed. The thickness of the formed organic luminous layer was 0.100 micrometers. Next, it was carried on the produced organic luminous layer, having used the sheet metal made from stainless steel as the mask so that the part which forms a cathode layer might be exposed. And the cathode layer of the configuration shown in drawing 3 was formed by carrying

out vacuum deposition of the Mg-Ag alloy to the thickness of 200nm, and removing a mask from on the. The luminescence display which was formed as mentioned above from the positive electrode layer, the electron hole transportation layer, the organic luminous layer, and the cathode layer and which consists of three organic EL devices was manufactured. The electrical potential difference of 20V is impressed between an ITO electrode and a Mg-Ag alloy electrode to one of the organic EL devices of the luminescence display produced as mentioned above, and it is 1400 cd/m2. Luminescence of brightness was observed.

[Translation done.]